Spectrograph at MSC

No further progress has been made towards obtaining an adequate solar image. Some time was devoted to trying to borrow a coelostat which could be used to supply a suitable image, but none was readily available. We then considered the problems involved in the construction of one. The main difficulty here was that the spectrograph is sited in a wooded area and there was no suitable location for a ground level horizontal coelostat. Since the instability of the solar tower ruled out the use of a vertical coelostat, the only alternative is to move the spectrograph to another site. To date, no decision has been made on such a move.

Beeth carried out preliminary investigations of the spectra of fluoresence caused by the recombination of atomic hydrogen on the surfaces of certain salts. The hope is that the discovery of characteristic spectra would provide the basis for the design of an atomic hydrogen detector. This work has also been delayed due to malfunctions in the two amplifiers of the spectrographs electronic recording system. These are currently being repaired and the collection of data should proceed rapidly once the instrument is again operative.

Among other possible laboratory studies being considered is the investigation of the conditions necessary for certain gases to emit visible radiation upon escaping from a porous medium in a vacuum. Such a study may provide insight into the reported emissions observed over certain craters on the moon.

Sunspot Evolution

Parker studied the evolution of 23 sunspot groups during their passage across the solar disc in which they produced a large Class 3 solar flare. The observations covered the period 1942-1962 and the idea behind the project was to see if one could define from the evolutionary pattern, some characteristics or configurations which would be associated only with those groups where the flare produced high energy protons ($>$ 1Bev). With the small sample available there seemed to be no suitable parameter, but the study emphasized the need for much better white light observations than were available for the period under consideration. We require sunspot patrols with high spacial and time resolution, and much more frequent observation of sunspot magnetic field polarities and strengths.

Cape of Good Hope H-alpha Solar Patrol

Dr. Reid continued the reduction of the data for the years 1958-1965 and this work is still in progress. Some additional computations were necessary and these were carried out at Sacramento Peak Observatory. The anomalous western asymmetry of the Class 1- flare was investigated in detail by Reid and Beeth, and it has been attributed to an inhomogeneous density distribution within the solar image on the filtergram. A paper entitled "Inhomogeneous Density Distribution in H-alpha Filtergrams and Flare Asymmetry" has been submitted for publication.

Interaction Of Interstellar Neutral Hydrogen with the Solar Wind

The interaction of neutral hydrogen from the interstellar medium with the solar wind and the field of the Sun's radiation was examined. A solution for the density of such neutral hydrogen in the vicinity of the Sun was obtained, assuming removal of neutral hydrogen from hyperbolic orbits by photoionization and by collision with solar wind protons. The effects of loading of the solar wind by photoionized neutral hydrogen cannot be neglected, since the density of the neutral hydrogen in the vicinity of the Sun will be much larger than in the interstellar medium. Also collisions between solar wind protons and the neutral hydrogen remove a significant amount of momentum from the hydromagnetic flow of the solar wind. Stopping distances were calculated for charge-exchange transfer of momentum between solar wind ions and the neutral hydrogen. For the densities usually taken for the interstellar medium, the flow would be severely attenuated inside two A. U. The loading of the solar wind by photoionization of neutral hydrogen would contribute a slightly greater amount to the attenuation of the flow speed. The effect of photoionization of energetic neutral hydrogen produced by charge exchange between solar wind protons and the interstellar hydrogen is to accelerate the hydromagnetic flow. This effect is presently under investigation. Complete solution of the flow interaction problem appears to be amenable only to computer solutions of the nonlinear differential equations. The problem is presently being formulated for such computer analysis.

The geophysical effects of the interstellar neutral hydrogen were outlined by calculating the flux of energetic neutral hydrogen expected at the earth's orbit due to charge-exchange collisions between solar wind protons and the interstellar hydrogen. The total energy flux in such energetic hydrogen at the earth was found to be too small to be significant for quiet conditions in the solar wind. During enhanced solar wind conditions, however, the steady-state quiet distribution of neutral hydrogen would be swept out. The energy delivered to the earth's surface by energetic neutral hydrogen during a solar wind enhancement appears to be sufficient to account for the main phase of geomagnetic storms.

The distribution of interstellar neutral hydrogen in the vicinity of the Sun, for the case in which the Sun moves relative to the interstellar medium, exhibits a singularity in the anti-apex direction. The structure of this singularity has been studied. Radio astronomy indicates a bright spot in the 21 cm. radiation from hydrogen in about the proper position to correspond to this singularity for the direction of the Sun's motion inferred from the proper motion of nearby stars. At present calculations are being made to give the intensity of 21 cm. radiation produced by the distribution of neutral hydrogen calculated in connection with the present work.

The above research was reported in a paper presented at the 47th Annual Meeting of the American Geophysical Union, April 17-20, Washington, D. C. (Trans. Am. Geophys. Union, 48, 170, 1967), and will be submitted in the near future to the Journal of Geophysical Research for publication.

Miscellaneous

Dr. Reid attended the Solar Physics Meeting at Santa Fe, New Mexico, organized by the High Altitude and Sacramento Peak Observatories. There were discussions on a wide variety of subjects, including the use of a videometer as a method of measuring flare variations with time.

A paper on "Solar Flares and Magnetic Fields" given at a NATO summer school in May 1965 was finally published in "Magnetism and the Cosmos" by Oliver and Boyd, Edinburgh in March 1967.